REMARKS

Claims 1-19 are pending. By this Amendment, Figures 11 and 14 are corrected by the attached Request for Approval of Drawing Corrections, and the specification is amended to address minor informalities and clarify the invention. No new matter has been added.

Prompt and favorable examination on the merits is respectfully solicited.

Respectfully submitted,

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Attachments:
Appendix
Request for Approval of Drawing Corrections

Date: April 4, 2002

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Alexandria, Virginia 22320
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DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Specification:

Page 32, line 18 - page 33, line 9:

With this embodiment, designating the maximum operating temperature of the insulation film of the field winding 111 as Tmax, it must be ensured that the level of field current that is passed during electric power generating operation by the synchronous machine ~~(more specifically, the current that is passed by the transistor 301 when it is operated at the maximum duty ratio, i.e., maximum ratio of ON interval to OFF interval for that transistor)~~ is limited to a value, determined by a specific value (referred to herein as DUTYmax) of duty ratio of ON/OFF switching of field current, whereby the temperature of the field winding 111 does not exceed a temperature value that is obtained by subtracting an amount ΔT from Tmax. Here, ΔT is a temperature increase amount that is essentially determined by thermal capacity of the field winding 111, its electrical insulation and the rotor core 2120 (i.e., thermal capacity of the rotor) and thermal capacity Q of the field winding 111 when engine starting is performed.

Page 33, line 24 through page 35, line 1:

Thermal specifications for the rotor of the synchronous machine, with this embodiment, are determined as follows. The maximum allowable temperature for the rotor will be designated as Tmax, the maximum temperature that can be attained by the rotor during electric power generation operation as Tgmax, and thermal capacity of the rotor as Q. Thermal capacity of the rotor is substantially determined as the sum of the specific heat of the rotor core material multiplied by the rotor mass and the specific heat of the material of the field winding multiplied by its mass. In addition, if the synchronous machine is of a type which also incorporates permanent magnets as described for the preceding embodiment, then thermal capacity of the permanent magnets must also be added, to obtain thermal capacity Q

of the rotor. In addition, the time interval during which field current is passed while engine starting is performed will be designated as T, the electrical resistance of the field winding as r, and the field current as i. In that case, with this embodiment, the maximum value of the field current i (in practice, the maximum field current that is supplied during engine starting operation, i.e., with the duty ratio used in switching ON/OFF control of the field current as described above being at its highest value, such as 100%) is controlled, and the values of Q, r, T and Tgmax respectively predetermined, such that the temperature value:

$(Tgmax + (i^2 . r . \cancel{t}\underline{T}) /Q)$

is lower than the temperature Tmax.

Page 35, lines 2-4:

Preferably it is ensured that $(Tgmax + (i^2 . r . \cancel{t}\underline{T}) /Q)$ is kept lower than the temperature Tmax by an amount which is within the range 20~40°C.

Page 36, lines 1-25:

With an alternative form of the second embodiment therefore, during a predetermined time interval that extends up to the point at which starting of the engine is commenced (i.e., the ignition switch of the vehicle is actuated to thereby supply an "engine start" command signal to the control circuit 400), the average field current, the average armature current and the ambient temperature, are measured, and these measured values are used in combination to estimate the temperature (designated as Tr) which the rotor will have attained at the point when engine starting is to begin. The aforementioned maximum value of duty ratio DUTYmax~~(designated in the following as DUTYmax, which is typically 100%)~~ that will be applied in ON/OFF switching control of the transistor 301 as described hereinabove to control the level of field current during electric generation operation is then obtained from an internal memory map (not shown in the drawings), based on the estimated temperature value Tr. For example, the higher the value of rotor temperature Tr, the greater is the extent to

which the duty ratio DUTYmax must be reduced, and conversely the lower the value of Tr the greater can be the DUTYmax. In that way, the maximum amount of electric power can be generated by the synchronous machine, consistent with the permissible range of values of rotor temperature Tr. This operation is illustrated in the flow diagram of Fig. 12.